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25JAN02 E690918-1 D10081
P01/7700 0.00-0201718.4

# Request for grant of a Patent

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| | | | |
|---|---|---|---|
| 1. Your reference | BEC/S3623-00024B | | |
| 2. Patent application number | 25 JAN 2002 0201718.4 | | |
| 3. Full name, address and postcode of the or each applicant<br><br>Patents ADP Number<br><br>If the applicant is a corporate body, give the country/state of incorporation | Spreckelsen McGeough Ltd<br>Sundial House<br>High Street<br>Horsell<br>Woking<br>Surrey GU21 4SU<br>United Kingdom<br><br>07443047001<br><br>England & Wales 07443047003 | | |
| 4. Title of Invention | Bottle Closures | | |
| 5. Name of agent<br><br>Address for service in the United Kingdom to which all correspondence should be sent<br><br>Patents ADP number<br>*(if you know it)* | **Nabarro Nathanson**<br>Lacon House<br>Theobald's Road<br>London<br><br>WC1X 8RW<br><br>05768304002 | | |
| 6. If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or each of these earlier applications and the or each application number | Country | Priority Application number | Date of filing |
| 7. If this application is divided or otherwise derived from an earlier UK application, give the number and filing date of the earlier application | Number of earlier application | | Date of filing |
| 8. Is a statement of inventorship and of right to grant of a patent required in support of this request? | Yes | | |

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| 9. Enter the number of sheets for any of the following items you are filing with this form. Do not count copies of the same document | |
| Continuation sheets of this form | |
| Description | 7 |
| Claims | - |
| Abstract | 1 |
| Drawing | 7 |
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| Priority documents | N/A |
| Translations of priority documents | N/A |
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| Request for search 9/77 | N/A |
| Request for examination 10/77 | N/A |
| Any other documents | N/A |
| | I/We request the grant of a patent on the basis of this application |
| Signature | [signature] |
| Name | Nabarro Nathanson<br>Agent for the Applicant |
| Date | 25 January, 2002 |
| Name and daytime telephone number of person to contact | Roy Scott<br>0207 524 6860 |

# Bottle Closures

## Background of the Invention

The present invention relates to closure technology for plastics bottles for carbonated and non-carbonated, pasteurised, aseptic or hot-fill products and more specifically to a process for assembling a plastics neck and cap assembly to such a plastics bottle. The predominant plastics material for gas-tight and heat-resist plastics bottles suitable for this purpose is PET (polyethylene terephthalate).

PET bottles cannot be used for sterilisation by retorting or autoclaving as is used for cans, glass bottles and some high heat resistant plastics such as polyethylene and polypropylene, as they cannot withstand the long exposure to temperatures of the order of 120 degrees C that are involved.

However sterile packaging in such plastics bottles can be achieved by an aseptic process or by hot filling.

In aseptic filling a UHT process is used to process the product prior to filling. The product is subjected to high temperature (140 degrees C) for a very short period (4 seconds) and then cooled to 4 degrees C. Once cooled the product must remain in sterile conditions and cannot be exposed to environmental air or bacteria. The bottles and caps must also be cleaned and sterilised, typically using Hydrogen Peroxide or Paracetic acid, which is evaporated off the components. The bottles are then filled and sealed in an aseptic environment. The packaging must also be sealed tightly enough to prevent re-infection. While this process is effective to provide long shelf-life products and can be used with PET bottles the cost of the filling plant is significant.

PET bottles are also used in hot filling processes in which the product is at a temperature of typically in excess of 85 degrees C as it enters the bottle. In this process the bottles must be clean but not necessarily sterile as any bacteria present will be killed by the hot product. Hot fill process are more economic but their applications are restricted by the limited heat resistance of PET, which suffers

distortion at temperatures over 75 degrees C. Greater than normal heat resistance can be obtained by crystallizing a neck of the bottle, but this increases the cost of the packaging.

A further technical problem is encountered when PET bottles are used in hot filling because a partial vacuum is created inside the bottle after it has been sealed as the product cools. This makes it necessary to develop constructions that prevent collapsing of the container. Examples of such structures are described in WO0113407 and WO0112531 in the name of Graham Packaging Company L P.

An injection stretch blow- moulded PET bottle will normally be sealed by means of an injection moulded cap which engages with features injection moulded on a neck of a preform prior to stretch blow-moulding. This will result in good sealing characteristics if the neck remains as originally moulded but begins to fail if there is distortion during the filling process. Since a tight seal is essential to prevent re-infection this limits the scope for using PET bottles in the more economical hot filling process. The present invention aims to solve this technical problem by the use of alternative closure technology.

The closure technology of the present invention is intended to be applicable to PET bottles or plastics bottles of PVC.

A neck and cap assembly has been described in WO 99/61337 (Spreckelsen McGeough Ltd). This type of closure technology has been applied to extrusion blow moulded bottles where the bottle body and the neck and cap assembly could be made of the same material, typically high density polyethylene (HDPE). Such a material has a typical melting point of 140°C. In this closure technology the bottle and neck and cap assembly are sealed together by means of an intervening plastics coated foil which is welded to both surfaces. The neck and cap assembly is applied to a bottle body after filling and would therefore not be affected by the passage of the hot filled product during hot filling. Technical problems are encountered if such a closure assembly is applied to a PET bottle.

The first technical problem relates to the distortion of a spout structure within the neck and cap assembly when it is subjected to temperatures sufficient to weld the foil to PET, which only melts at 220°C although some distortion will occur at lower temperatures. It is not practicable to make the spout structure from PET as this material is too brittle for injection moulding a component of this type.

A second technical problem of low weld strength arises if lower temperatures are used to produce the weld between the plastics coated foil and the PET bottle. This may result in a weld which is not strong enough to hold in the pressure of a carbonated product. If the weld joining the neck and cap assembly to the bottle body is weak it may be possible to remove the assembly at this junction by applying a lever under a skirt of the assembly and using a transport ring of the bottle as a pivot support. This undermines the use of the foil to provide tamper evidence. Prior art proposals such as described in GB-A- 2108464 (Container Corporation of America) suggest welding a foil onto an upper flat top surface of a container. Unfortunately, this proposal cannot be adapted to sterile packaging containers because of the weakness of the weld strength as described above.

Typically PET containers are manufactured from injection moulded preforms which are subsequently stretch blow moulded to the required shape. Because the PET bottles are typically used with screw caps, a neck of the preform is moulded with integral screw threads to engage with the cap. The presence of these formations on the neck requires a more complex mould and a significant amount of material. A considerable portion of the cost and weight of a PET bottle is represented by the need to create a complex neck structure to engage with the screw cap.

It will be appreciated that the foil sealed neck and cap assembly as described in WO 99/61337 referred to above does not require the use of any specific formation on a neck of the bottle body itself and therefore the use of this type of closure instead of the conventional screw cap has the advantage that a much simpler preform having a completely smooth neck can be used . This would eliminate the need for side splits in an upper part of an injection mould as would be required for moulding screw threads.

Less material can also be employed. A smooth neck is also easier to keep sterile and to clean. Simpler preforms can also be produced more reliably.

The solution of the present invention resides in the use of a neck and cap assembly having a foil, coated with a plastics material compatible with the material of the bottle, at the base of the assembly by means of which it is secured to a neck of a bottle body by means of a weld between the foil and a side wall of the neck.

By welding to a side wall which, in the case of a standard cylindrical neck in normal orientation would be vertical, advantage is taken of the improved relative strength of a PET weld in sheer rather than in tension. When a ring pull secured to an opposite side of the foil is used to tear the foil the force applied is directed along the vertical axis of the neck and this therefore places a sheer force on the weld and not a tension force as would be the case if the weld were on the top horizontal face of the neck as suggested by Container Corporation and used in the construction of the earlier closure with extrusion blow moulded bottles. The force applied to this vertical weld if any attempt is made to lever off the assembly is also now a sheer force on the weld. Therefore such a closure provides the necessary security, as any attempted removal would, if successful, result in evident damage on the closure.

Although it has been proposed to wrap a conduction foil, which is plastics coated on a lower side only, round a side wall of a bottle, it has hitherto always been the case that welds have been made between the foil and a horizontal upper surface of the bottle neck that is easily accessible to a heated iron. Conduction foil capsules have also been provided with side walls to give the foil some structural stability during the assembly process before they are placed on a bottle. A secondary over-cap is then needed to overlie the conduction foil. This type of closure technology does not provide a good resealing capability once the foil has been removed whereas the closure technology of WO 99/61337 (Spreckelsen McGeough Ltd) provides an excellent resealing capability.

## Brief Description of the Drawings

In order that the invention may be well understood an embodiment thereof will now be described, by way of example only, with reference to the accompanying diagrammatic drawings, in which:

Figure 1A shows a cross section through a first PET preform suitable for use in the present invention;

Figure 1B shows a detail of a top portion of the preform of Figure 1A

Figure 1C shows a cross section through a second PET preform suitable for use in the present invention;

Figure 1D shows a detail of a top portion of the preform of Figure 1C

Figure 2 shows a detail from a cross section of a neck and cap assembly secured to a bottle neck made from the preform of Figures 1A and 1B;

Figure 3 shows a detail similar to Figure 3 with the cap removed showing an alternative configuration for the weld position on an inner face of a side wall of the bottle neck; and

Figure 4 shows a detail from a cross section of a neck and cap assembly illustrating the use of an oversized foil in a hot filling process using the closure technology of the present invention.

## Detailed Description of a Preferred Embodiment

A PET bottle will be described for the purposes of this example. However other materials such as PVC can be used.

A preform 2 for a PET bottle is injection moulded from PET in a conventional manner. The preform 2 has a body portion 4, which comprises the material which will be stretch blow moulded to form the bottle body, and a neck portion 6. The neck portion 6 and body portion 4 are separated by a transport ring 8. This ring 8 is created

at the junction of two mould parts used to mould the preform. The neck portion 6 has a reduced height relative to a conventional preform with screw threads as the neck portion only needs to be tall enough to support a skirt 20 of a neck and cap assembly 22.

The neck portion 6 is preferably a simple cylindrical side wall 10 devoid of moulded features for maximum economy and minimum weight as shown in Figures 1A and B. However a rib 12 may be formed at or adjacent an open mouth 14 of the neck portion 6 as shown in Figure 1D to aid in positioning of the neck and cap assembly 22.

The neck and cap assembly 22 is of the same construction as that described in WO 99/61337 (Spreckelsen McGeough Ltd) to which reference may be made. The neck and cap assembly 22 has a neck 24 formed from the skirt 20 and a spout 26 to which a cap 28 is snap fitted. The skirt 20 merges with the spout 26 at a horizontal flange 30. A foil 40 is welded across the neck 24 and secured to an underside of the flange 30. A ring pull structure 32 is provided inside the neck 24 to allow the foil 40 to be removed.

In the prior art assembly for use with HDPE, the foil 40 is entirely flat but in accordance with a first embodiment of the present invention the foil 40 has a section 42 that depends downwardly around the inside of the skirt 20 so that it can be welded to an outer surface of the side wall 10. Instead of relying on a weld in a plane of the horizontal flange 30 but rather one between a side wall 10 of the neck portion 6 and the depending section 42 of the foil 40, a sheer force is applied to the weld when the ring pull structure 32 is used to open the closure or when any attempt is made to lever the assembly from the bottle.

In an alternative embodiment as shown in Figure 3 a flat foil 40 is provided across the whole of the neck 24 so that when the neck and cap assembly 22 is applied to the bottle body the foil is pushed down adjacent an inner part of the side wall 10. This can be made to happen by the application during an induction heating cycle of downward fitting force over the spout 26 which is forced into the neck 6 of the bottle as the

material of the flange 30 is deformed. In this case an annular portion 44 of the foil 40 which previously lay underneath the outermost part of the flange 30 before the deformation now extends upwards from a central portion of the foil and is welded to the interior of the side wall 10. As in the previously described embodiment this weld is also placed in sheer rather than tension when the foil 40 is opened by the ring pull structure 32 or any attempt is made to prise the assembly off by placing a lever under the skirt 20.

A side wall 10 weld is less sensitive to warping of the neck portion 6 that may occur during the hot filling process or the application of heat to produce the weld. This may create significant deformations of the top surface that would make a weld against that surface unachievable while a side wall weld is less affected.

Figure 4 illustrates an oversized foil 40 but with the weld to the neck portion 6 being adjacent the outer face of the side wall 10. This embodiment is specifically adapted for hot filling. Here the foil 40 is puffed up into the interior of the spout during fitting and is allowed to flex inwardly (as shown in the drawing) during cooling after the weld has been formed to partially relieve the vacuum created inside the bottle body. This allows this closure technology to be used with bottle bodies that do not need reinforcing pressure panels to withstand the vacuum created after filling.

This type of closure technology will permit hot fill applications in excess of 75 degrees C without the use of preform neck crystallization as some degree of neck deformation can be accommodated by the side wall welding.

In the embodiments described a neck and cap assembly 22 with a snap on cap 28 has been shown. If the bottle is to be used with a carbonated product the neck 26 would be provided with screw threads to engage with a srew-on over cap for resealing purposes.

# Abstract

## Bottle Closures

A neck and cap assembly (22) is secured to a neck portion (6) of a PET bottle by means of a foil (40) that is welded both to the inside flange (30) of the neck (24) and - by means of a depending portion (42) - to a side wall (10) of the bottle body so that forces on the weld between foil portion (42) and the bottle tending to open the seal are in sheer rather than in tension.

(Figure 2)

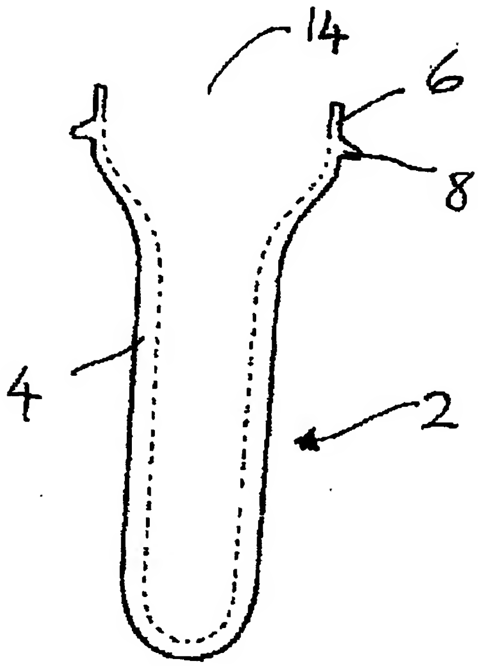


Fig 1A

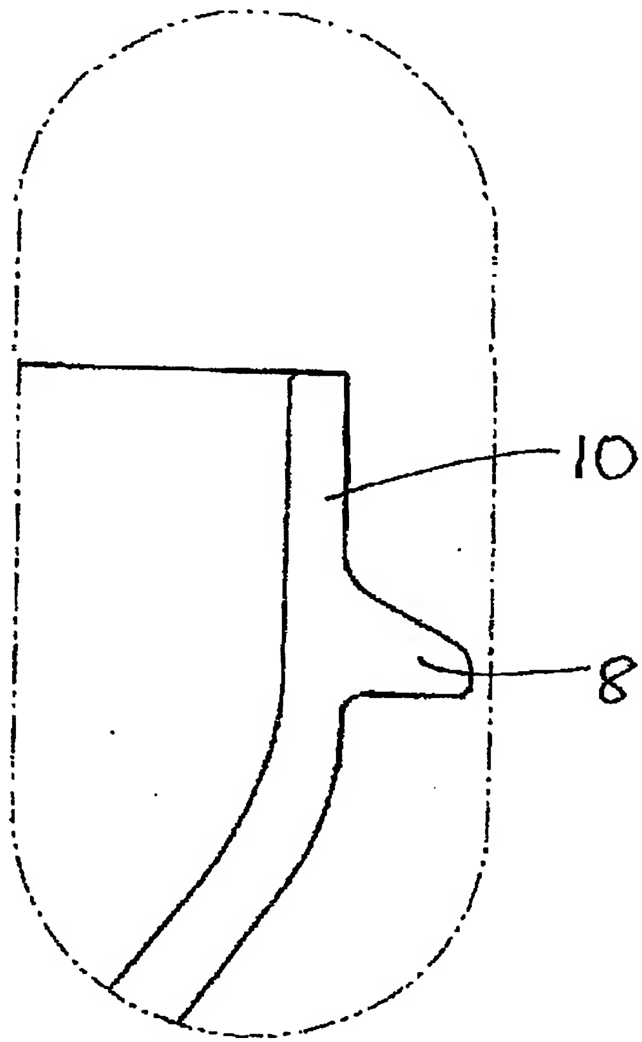


Fig 1B

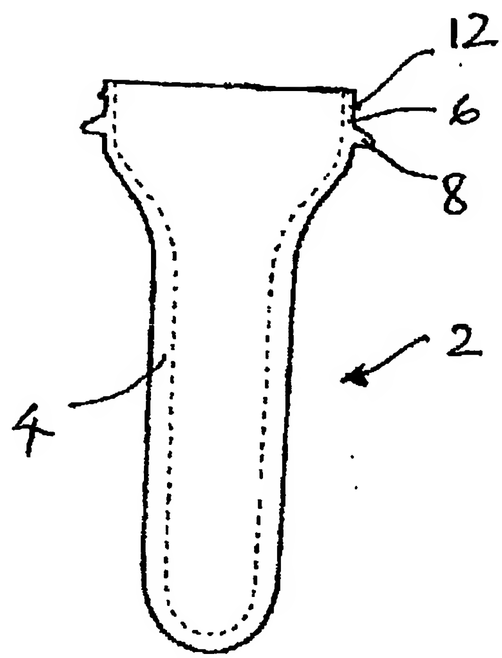


Fig 1C

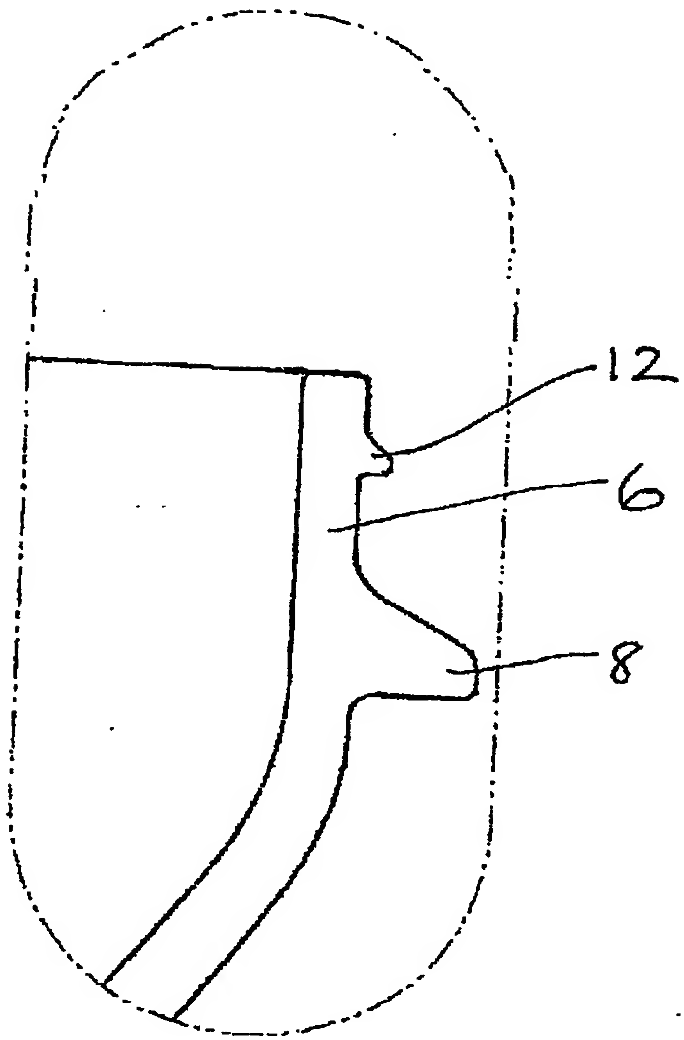


Fig 1D

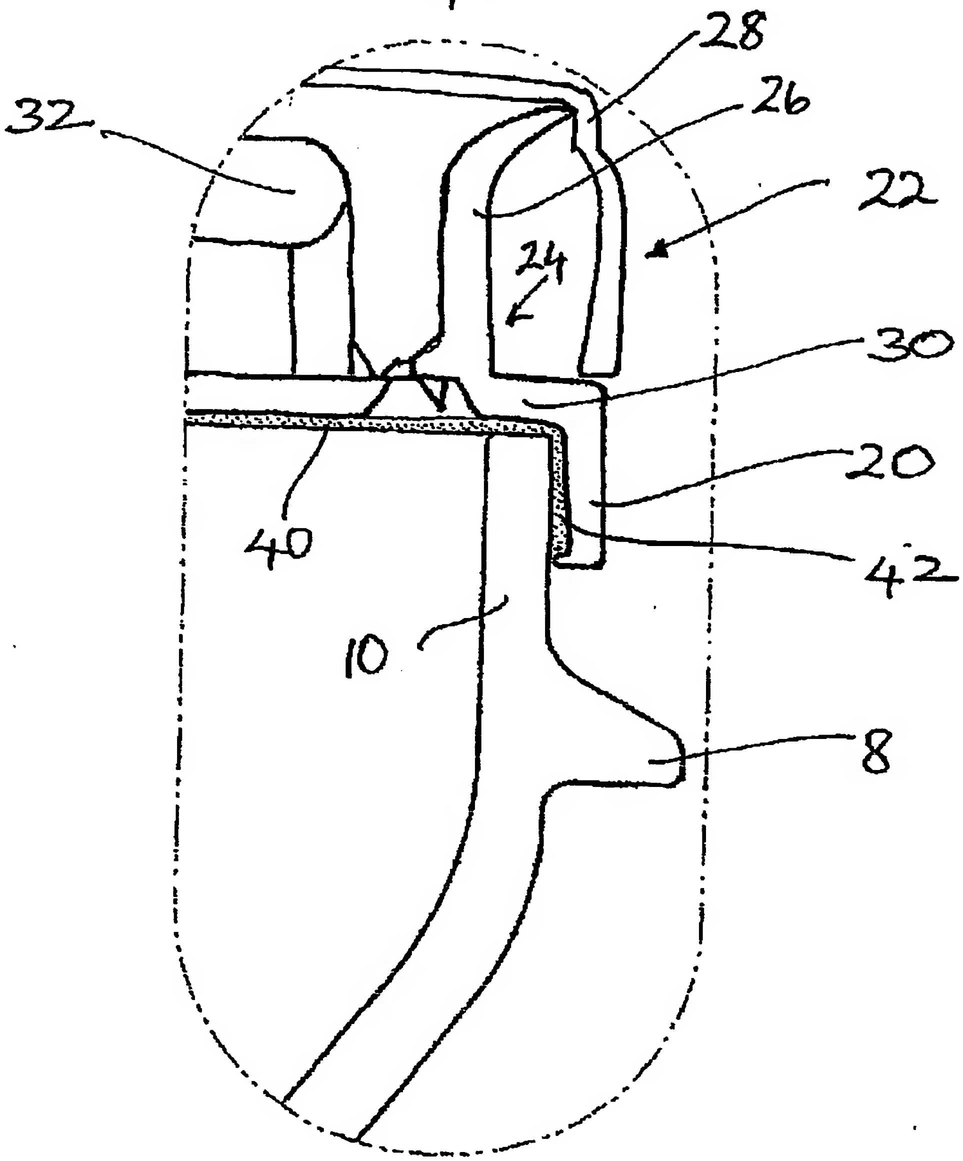


Fig 2

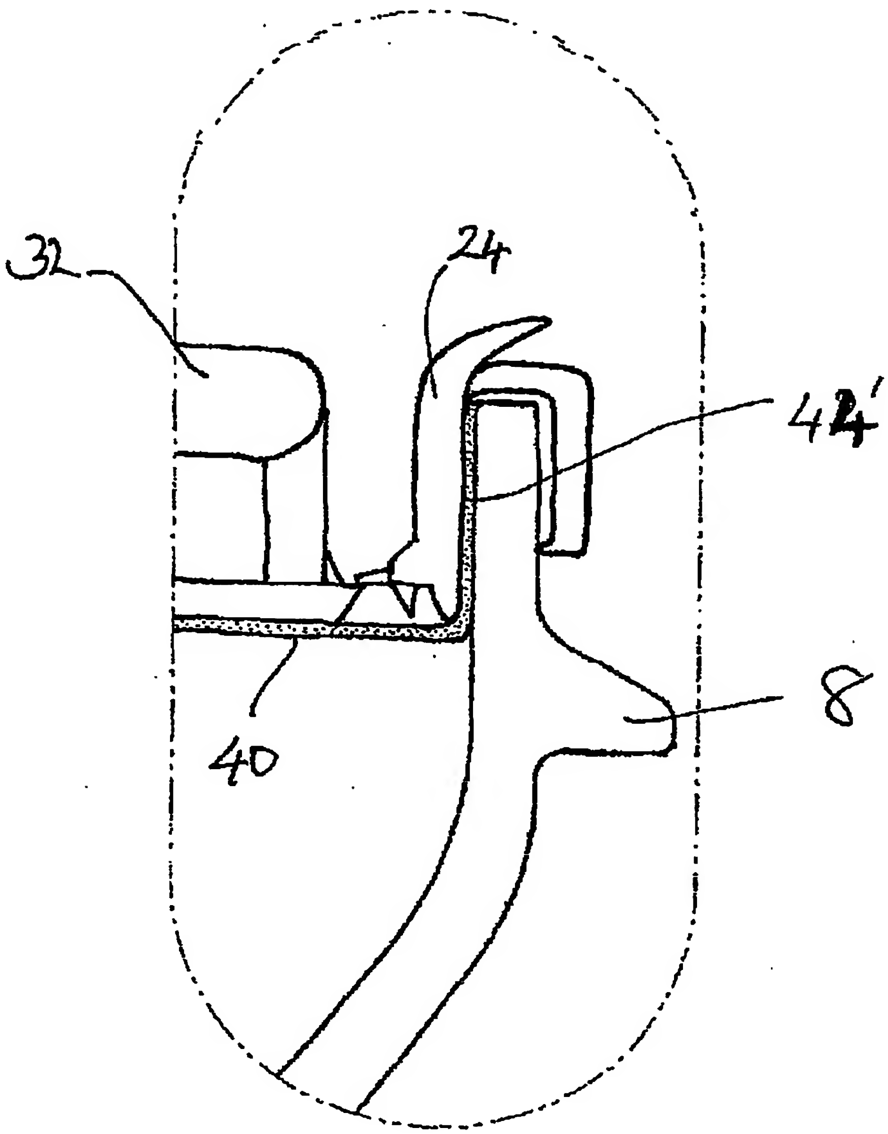


Fig 3

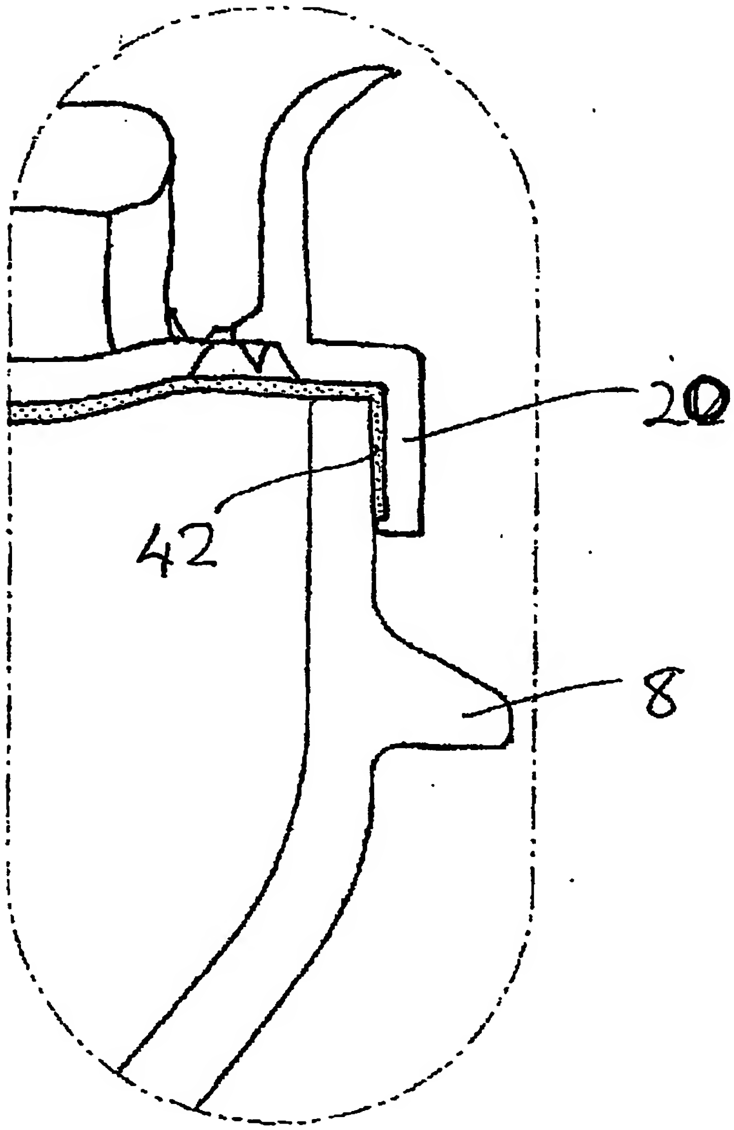


Fig 4